The DOCTRINE *of* ADFECTED EQUATIONS *Epitomized:*

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Humbly submitted to the Censure of the Honoured Sir* George Wharton *Baronet, Sir* Jonas Moore *Knight,* Edward Sherburne *Esq;* James Hoare *jun. Esq;

CHAP. I.

Of Reduction, &c.

THe Reduction of an Equation having its second term extant, to a new Equation of the same degree, wherein the second term shall be abolished: in which Reduction the *Habitudes* of the new Coefficients to the old are made conspicuous, whereby you may descry when such a term or terms will be abolished with the second.

Because I would not be blamed for Innovation in the Mathematicks, in regard I have introduced two new Signs, (to wit) the Sign of *Retention*, and the Sign of *Mutation*, which I conceive are very commodious and beneficial; I shall give you their explanation. This Sign $\dashv$ prefixed to any Quantity, signifies that the Sign of that Quantity is to be retained or kept, whether it be $+$ or $-$: as $\dashv 5abz \dashv ef \dashv y$ intimates that the respective Signs of these Quantities are to be kept. This Sign $\vdash$ prefixed to any Quantity, signifies that the Sign of that Quantity is to be changed, whether it be $+$ or $-$: as $\vdash 5abz \vdash ef \vdash y$ intimates that the respective Signs of these Quantities are to be changed.

Note 1. In the Æquations following, that in the Quadraticks, if the Coefficient of the second term be not 2 or some multiple of 2, you will be incumbred with Fractions; which to avoid you may multiply all the Coefficients by a rank of continual Proportionals from Unity whose *Ratio* is 2. And for the like reason in the Cubicks, if the Coefficient of the second term be not 3, or some multiple of 3, you may multiply all the Coefficients by a rank of continual Proportionals from Unity whose *Ratio* is 3. And in the Biquadraticks, if the Coefficient of the second term be not 4 or some multiple of 4, you may multiply all the Coefficients by a rank of continual Proportionals from Unity whose *Ratio* is 4: and by so doing you will be accommodated with whole numbers for any Equation, whether it be Quadratick, or Cubick, or Biquadratick.

Note 2. In any of the Æquations following in this Chapter, if the last term shall drop off, then is $\vdash a = z$: and if the two last terms shall drop off, then there is a pair of Equal Roots in the Equation proposed: and if the three last terms shall drop off, then there is a Trey of Equal Roots in the Equation proposed. &c.

Prop. 1. In a quadratick Equation, to take away the second term, let the Equation proposed be this:

$$+zz \dashv 2az \dashv b = 0$$

If you put or substitute $+l \vdash a = z$, then will the *Canon* for the new Equation result thus:

$$+ll\ *\left.\begin{matrix}\vdash aa\\ \dashv b\end{matrix}\right\}=0$$

Consect. If the Equation proposed shall have either of these two following Habitudes, then the third term also shall be abolished as well as the second.

$$+zz+2az+aa=0$$
$$+zz-2az+aa=0$$

Prop. 2. In a Cubick Equation, to take away the second term, let the Equation proposed be this:

$$+zzz \dashv 3azz \dashv bz \dashv c = 0$$

If you put $+l \vdash a = z$, then will the *Canon* for the new Equation result thus:

$$+lll\ *\left.\begin{matrix}\vdash 3aal & \dashv 2aaa\\ \dashv bl & \vdash ab\\ & +c\end{matrix}\right\}=0$$

Consect. 1. If the Equation proposed shall have either of these two following Habitudes, then the third term also shall be abolished as well as the second.

$$+zzz+3azz+3aaz \dashv c=0$$
$$+zzz-3azz+3aaz \dashv c=0$$

Consect. 2. If the Equation proposed shall have any of these four following Habitudes, then the fourth term also shall be abolished as well as the second.

$$+zzz+3azz+bz\left.\begin{matrix}-2aaa\\ +ab\end{matrix}\right\}=0$$
$$+zzz+3azz-bz\left.\begin{matrix}-2aaa\\ -ab\end{matrix}\right\}=0$$
$$+zzz-3azz+bz\left.\begin{matrix}+2aaa\\ -ab\end{matrix}\right\}=0$$
$$+zzz-3azz-bz\left.\begin{matrix}+2aaa\\ +ab\end{matrix}\right\}=0$$

Consect. 3. If the Equation proposed shall have either of these two following Habitudes, then the third and fourth terms also shall be abolished as well as the second.

$$+zzz+3azz+3aaz+aaa=0$$
$$+zzz-3azz+3aaz-aaa=0$$

Prop. 3. In a Biquadratick Equation, to take away the second term, let the Equation proposed be this.

$$+zzzz \dashv 4azzz \dashv bzz \dashv cz \dashv d = 0$$

If you put $+l \vdash a = z$, then will the *Canon* for the new Equation result thus:

$$+llll\ *\left.\begin{matrix}\vdash 6aall & \dashv 8aaal & \vdash 3aaaa\\ \dashv bll & \vdash 2abl & \dashv aab\\ & \dashv cl & \vdash ac\\ & & \dashv d\end{matrix}\right\}=0$$

Consect. 1. If the Equation proposed shall have either of these two following Habitudes, then the third term also shall be abolished as well as the second.

$$+zzzz+4azzz+6aazz \dashv cz \dashv d=0$$
$$+zzzz-4azzz+6aazz \dashv cz \dashv d=0$$

Consect. 2. If the Equation proposed shall have any of these four following Habitudes, then the fourth term also shall be abolished as well as the second.

$$+zzzz+4azzz+bzz\begin{matrix}-8aaaz\\ +2abz\end{matrix}\dashv d=0$$
$$+zzzz+4azzz-bzz\begin{matrix}-8aaaz\\ -2abz\end{matrix}\dashv d=0$$
$$+zzzz-4azzz+bzz\begin{matrix}+8aaaz\\ -2abz\end{matrix}\dashv d=0$$
$$+zzzz-4azzz-bzz\begin{matrix}+8aaaz\\ +2abz\end{matrix}\dashv d=0$$

Consect. 3. If the Equation proposed shall have any of these eight following Habitudes, then the fifth term also shall be abolished as well as the second.

$$+zzzz+4azzz+bzz+cz\left.\begin{matrix}+3aaaa\\ -aab\\ +ac\end{matrix}\right\}=0$$
$$+zzzz+4azzz+bzz-cz\left.\begin{matrix}+3aaaa\\ -aab\\ -ac\end{matrix}\right\}=0$$
$$+zzzz+4azzz-bzz+cz\left.\begin{matrix}+3aaaa\\ +aab\\ +ac\end{matrix}\right\}=0$$
$$+zzzz+4azzz-bzz-cz\left.\begin{matrix}+3aaaa\\ +aab\\ -ac\end{matrix}\right\}=0$$
$$+zzzz-4azzz+bzz+cz\left.\begin{matrix}+3aaaa\\ -aab\\ -ac\end{matrix}\right\}=0$$
$$+zzzz-4azzz+bzz-cz\left.\begin{matrix}+3aaaa\\ -aab\\ +ac\end{matrix}\right\}=0$$
$$+zzzz-4azzz-bzz+cz\left.\begin{matrix}+3aaaa\\ +aab\\ -ac\end{matrix}\right\}=0$$
$$+zzzz-4azzz-bzz-cz\left.\begin{matrix}+3aaaa\\ +aab\\ +ac\end{matrix}\right\}=0$$

Consect. 4. If the Equation proposed shall have either of these two following Habitudes, then the third and fourth terms also shall be abolished as well as the second.

$$+zzzz+4azzz+6aazz+4aaaz \dashv d=0$$
$$+zzzz-4azzz+6aazz-4aaaz \dashv d=0$$

Consect. 5. If the Equation proposed shall have any of these four following Habitudes, then the third and fifth terms also shall be abolished as well as the second.

$$+zzzz+4azzz+6aazz+cz\left.\begin{matrix}-3aaaa\\ +ac\end{matrix}\right\}=0$$
$$+zzzz+4azzz+6aazz-cz\left.\begin{matrix}-3aaaa\\ -ac\end{matrix}\right\}=0$$
$$+zzzz-4azzz+6aazz+cz\left.\begin{matrix}-3aaaa\\ -ac\end{matrix}\right\}=0$$
$$+zzzz-4azzz+6aazz-cz\left.\begin{matrix}-3aaaa\\ +ac\end{matrix}\right\}=0$$

Consect. 6. If the Equation proposed shall have any of these four following Habitudes, then the fourth and fifth termes also shall be abolished as well as the second.

$$+zzzz+4azzz+bzz\begin{matrix}-8aaaz\\ +2abz\end{matrix}\left.\begin{matrix}-5aaaa\\ +aab\end{matrix}\right\}=0.$$
$$+zzzz+4azzz-bzz\begin{matrix}-8aaaz\\ -2abz\end{matrix}\left.\begin{matrix}-5aaaa\\ -aab\end{matrix}\right\}=0$$
$$+zzzz-4azzz+bzz\begin{matrix}+8aaaz\\ -2abz\end{matrix}\left.\begin{matrix}-5aaaa\\ +aab\end{matrix}\right\}=0$$
$$+zzzz-4azzz-bzz\begin{matrix}+8aaaz\\ +2abz\end{matrix}\left.\begin{matrix}-5aaaa\\ -aab\end{matrix}\right\}=0$$

Consect. 7. If the Equation proposed shall have either of these two following Habitudes, then the third, fourth, and fifth terms also shall be abolished as well as the second.

$$+zzzz+4azzz+6aazz+4aaaz+aaaa=0$$
$$+zzzz-4azzz+6aazz-4aaaz+aaaa=0$$

There be other kind of Habitudes which I have not room to explain here, onely I shall mention one.

In an Equation consisting of four terms (to wit) the two highest, and the two lowest, the supreme term being cleared of its Coefficient, and the Resolvend equal to the fact of the Coefficients of the two mean terms, ~~it holds as follo~~weth:

$y^3 - ay^2 - by + ab = 0$, here $+a = y$, & $+\sqrt{b} = y$, & $-\sqrt{b} = y$.

$y^4 + ay^3 * - cy - ac = 0$, here $-a = y$, & $+\sqrt[3]{c} = y$.

$y^5 - ay^4 ** - dy + ad = 0$, here $+a = y$, & $+\sqrt[4]{d} = y$.

CHAP. II.

Of the Solution of Quadratick and Cubick Equations adfected.

THe *Solution* of Quadratick Equation adfected may be delivered thus:

The Equation proposed, let be $\}\ +zz = \dashv 2az \dashv b$

The Equation resolved, is $\left\{\begin{matrix}\dashv z = \dashv a + \sqrt{:aa \dashv b:}\\ \dashv z = \dashv a - \sqrt{:aa \dashv b:}\end{matrix}\right.$

The solution of Cubick Equations adfected (wherein the second term is not) may be delivered thus: in three Cases.

Case 1. *The Equation proposed, let be* $\}\ +zzz = -3bz \dashv 2c$

The Equation resolved, is $\}\ \dashv y = \sqrt[3]{:\vdash c + \sqrt{:cc+bbb:}}$

Thus having got the value of $\dashv y$, by restitution it holds $\frac{b}{y} \vdash y = z$.

Case 2. *The Equation proposed, let be* $\}\ +zzz = +3bz \dashv 2c$

(And here it is required that bbb be not greater then cc.)

The Equation resolved, is $\}\ \dashv y = \sqrt[3]{:\dashv c + \sqrt{:cc-bbb:}}$

Thus having got the value of $\dashv y$, by restitution it holds $\frac{b}{y} \dashv y = z$.

But if $bbb = cc$, then $\frac{\vdash c}{\dashv b} = z$. again $\frac{\vdash c}{\dashv b} = z$. also $\frac{\dashv 2c}{\dashv b} = z$

Case 3. When bbb is greater then cc, the best way of resolving the Equation, is by the general method, or else by approachment, which you fansie best: except you can espie a Root among the Divisors of the Resolvend.

CHAP. III.

Of the Comparison of adfected Equations.

Prop. TWo Equations being proposed, having one and the same common Root; To expound that common Root without resolving either of the Equations proposed.

1. Examples in the Quadraticks.

The two Equations proposed, let be $\left\{\begin{matrix}+z^2 \dashv az \dashv b = 0\\ +z \dashv p = 0\end{matrix}\right.$

The Equation resulting, is $\}\ \dashv z = \frac{\vdash b}{\dashv a \vdash p}$

The two Equations proposed, let be $\left\{\begin{matrix}+z^2 \dashv az \dashv b = 0\\ +z^2 \dashv pz \dashv q = 0\end{matrix}\right.$

The Equation resulting, is $\}\ \dashv z = \frac{\dashv q \vdash b}{\dashv a \vdash p}$

2. Examples in the Cubicks.

The two Equations proposed, let be $\left\{\begin{matrix}+z^3 \dashv az^2 \dashv bz \dashv c = 0\\ +z \dashv p = 0\end{matrix}\right.$

The Equation resulting, is $\}\ \dashv z = \frac{\vdash c}{\dashv pp \dashv b \vdash ap}$

The two Equations proposed, let be $\left\{\begin{matrix}+z^3 \dashv az^2 \dashv bz \dashv c = 0\\ +z^2 \dashv pz \dashv q = 0\end{matrix}\right.$

The Equation resulting, is $\}\ \dashv z = \frac{\dashv aq \vdash pq \vdash c}{\dashv pp \dashv b \vdash ap \vdash q}$

The two Equations proposed, let be $\left\{\begin{matrix}+z^3 \dashv az^2 \dashv bz \dashv c = 0\\ +z^3 \dashv pz^2 \dashv qz \dashv r = 0\end{matrix}\right.$

The Equation resulting, is $\}\ \dashv z^2 = \frac{\dashv q \vdash b}{\dashv a \vdash p}z\ \frac{\dashv r \vdash c}{\dashv a \vdash p}$

3. Examples in the Biquadraticks.

The two Equations proposed, let be $\left\{\begin{matrix}+z^4 \dashv az^3 \dashv bz^2 \dashv cz \dashv d = 0\\ +z \dashv p = 0\end{matrix}\right.$

The Equation resulting, is $\}\ \dashv z = \frac{\vdash d}{\dashv app \dashv c \vdash bp \vdash ppp}$

The two Equations proposed, let be $\left\{\begin{matrix}+z^4 \dashv az^3 \dashv bz^2 \dashv cz \dashv d = 0.\\ +z^2 \dashv pz \dashv q = 0\end{matrix}\right.$

The Equation resulting, is $\}\ \dashv z = \frac{\dashv bq \dashv ppq \vdash apq \vdash qq \vdash d}{\dashv app \dashv 2pq \dashv c \vdash aq \vdash bp \vdash ppp}$

The two Equations proposed, let be $\left\{\begin{matrix}+z^4 \dashv az^3 \dashv bz^2 \dashv cz \dashv d = 0\\ +z^3 \dashv pz^2 \dashv qz \dashv r = 0\end{matrix}\right.$

The Equation resulting, is $\}\ \dashv z^2 = \frac{\dashv aq \dashv r \vdash c \vdash pq}{\dashv pp \dashv b \vdash ap \vdash q}z\ \frac{\dashv ar \vdash pr \vdash d}{\dashv pp \dashv b \vdash ap \vdash q}$

The two Equations proposed, let be $\left\{\begin{matrix}+z^4 \dashv az^3 \dashv bz^2 \dashv cz \dashv d = 0\\ +z^4 \dashv pz^3 \dashv qz^2 \dashv rz \dashv s = 0\end{matrix}\right.$

The Equation resulting, is $\}\ \dashv z^3 = \frac{\dashv q \vdash b}{\dashv a \vdash p}z^2\ \frac{\dashv r \vdash c}{\dashv a \vdash p}z\ \frac{\dashv s \vdash d}{\dashv a \vdash p}$

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